Concrete Patio Slope

Q. I am an arbitrator on a lawsuit that involves a concrete slab-on-ground patio for a multi-family residential building. One of the issues is the slope of the slab. Can you direct me to any ACI documents covering that topic?

A. The only ACI document that discusses slope of exterior patio slabs is ACI 302.1R-04.1 It states that: “Positive drainage requires a slope of 1/4 in./ft (20 mm/m).” However, even at this slope, some standing water (often called birdbaths) should be expected after a rain due to construction tolerances and normal surface deformations over time. Standard construction tolerances, such as the flatness/levelness ($F/F^*$) of the patio slab and the elevation of the drain inlets, do not prevent local areas of ponding from occurring. Therefore, it is unreasonable to expect a slab free of the potential for birdbaths or puddles.

ACI 117-102 includes tolerances for flatness/levelness and elevation. As finished slab surfaces are not perfectly flat or perfectly level, allowable deviations occur that inhibit the drainage of all of the water, even with a slope of 1/4 in. per ft (20 mm per m). In addition, there is a tolerance to the elevation of the drain, which establishes the low point of the surface as well as the slope from the specified slab surface elevation.

Once a slab is placed, it is also exposed to ambient conditions that can cause normal deformations due to temperature and moisture gradients that develop through the depth of the slab. This deformation is often called curling or warping, where the edges of slab panels deform upward when the surface of the slab is cooler or drier than the bottom. The slab surface contracts or shrinks more than the slab bottom. Regardless of how the slab is finished, curling/warping can result in high points along joints, cracks, and slab edges and low spots that contribute to the formation of birdbaths…

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Your question could also be related to accessibility issues, so you should refer to the accessible design standards associated with the Americans with Disabilities Act (ADA).3 Per Section 403.3 of that standard: “The running slope of walking surfaces shall not be steeper than 1:20. The cross slope of walking surfaces shall not be steeper than 1:48.” Because one could walk in any direction on a patio slab, 1:48 (1/4 in./ft) would also appear to be the maximum allowable slope for the slab in question, which presents a dilemma. When drainage is required on surfaces at facilities covered by the ADA, the minimum and maximum slope become the same.

References

2. ACI Committee 117, “Specifications for Tolerances for Concrete Construction and Materials (ACI 117-10) and Commentary,” American Concrete Institute, Farmington Hills, MI, 2010, 76 pp.

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